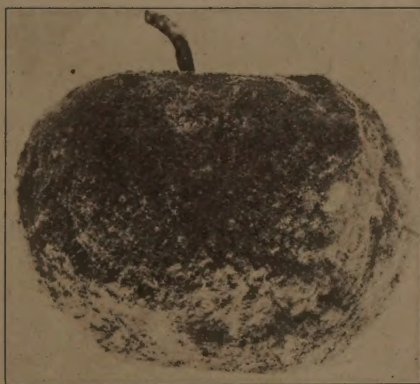


WEST VIRGINIA UNIVERSITY
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Diseases
Apple Enemies
AND
How to Fight Them



By W. M. MUNSON.

[The Bulletins and Reports of this Station will be mailed free to any citizen of West Virginia upon written application. Address Director of Agricultural Experiment Station, Morgantown, W. Va.]

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April 16, 1909.

This bulletin concerning Means for Controlling Enemies of the Apple is the second of a series of practical bulletins to be issued by this Station from time to time for the promotion of the horticultural and trucking industries of the State. The first bulletin is upon the subject of Certain Enemies of Cabbage and How to Destroy Them.

J. H. STEWART.

Director.

Apple Enemies, and How to Fight Them

W. M. MUNSON.

As the apple becomes an increasingly important factor in the wealth of the state, the question of protecting this fruit from the ravages of disease and of insects and other enemies, becomes of correspondingly greater moment. The most commonly accepted method of treatment, at present, is by the use of the modern spray pump.

THE REASON FOR SPRAYING.

By far the larger proportion of the enemies of the apple may be held in check by spraying the trees with one or more of the common insecticides or fungicides now offered. By a combination of materials, several enemies may, in many cases, be successfully checked with one application. There should, however, be a definite purpose in view for every application. The mere fact of spraying, is not enough. Vast sums of money are wasted every year because of the use of wrong materials, improper mixing, slovenly or inefficient field work with the pump, or neglect of the operation until too late in the season. *Delays are dangerous! Spraying is a preventive measure and not a cure*, and should be looked upon as, in a sense, plant insurance.

HOW TO SPRAY.

Use a good spray pump, and do not fear to apply plenty of pressure. The best results are obtained from the use of a power sprayer which will give 100 to 200 pounds pressure. *Sprinkling is not spraying!* The spray should be applied as a fine mist which will settle all over the tree,—on the under as well as on the upper surfaces of the leaves. There is a tendency in some

parts of the country to return to the use of the coarse nozzle which was in use 20 years ago, and to depend upon high pressure to force the spraying material where desired. It is doubtful, however, if, in our moist climate, and for general orchard practice, this can be recommended, as yet. Studies of this question are in progress at several experiment stations at the present time.

The fine mist referred to, is best produced by using a fine nozzle (as Vermorel, Friend, Mistry, or some similar type) and high pressure; and *every portion of the tree should be covered,—top, sides, branches, trunk.*

In order to reach the tops of the trees, a bamboo extension rod is almost indispensable (but be sure and get one with a shut-off cock at the base.) *One thorough spraying at the right time is worth 10 careless treatments.*

WHEN TO SPRAY.

An early spring treatment with lime-sulphur, or with copper sulphate or Bordeaux mixture, is a most valuable aid in controlling the fungous diseases, such as apple scab, bitter rot, canker, etc.; also it might be added, for leaf curl and scab of peach, and for brown rot, plum pockets, and probably black knot of plum. Spray early and, especially in wet seasons, spray often,—not fewer than 4 or 5 times during the season. If a heavy rain occur soon after spraying, repeat the treatment. Spraying mixture that is washed to the ground is of no value as a protection to the trees. If one of the soluble oils is used, application should be made in fall or early winter.

For the San Jose scale, spraying *must* be done in fall, winter or spring, before the buds start. It is generally conceded that spring is the best time for treatment with lime-sulphur mixture, but owing to pressure of other work, and to the condition of the ground in spring, this treatment is frequently given too early for the best results.

OTHER FACTORS INVOLVED.

Spraying will not insure a bountiful crop of perfect fruit, any more than carrying an insurance policy, or maintaining a well filled medicine chest will ward off the ills to which man is subject. Clean cultivation, the removal of dead wood and of decayed and diseased fruits, leaves, and branches; the admission of air and sunlight, by proper pruning; a well drained, friable soil; an abundance of plant food—these and many other factors which go to make up what is universally recognized as “good culture,” are essential to the fullest success and satisfaction in commercial fruit growing.

SOME INSECT ENEMIES.

The insect enemies of the apple may be conveniently arranged in groups, *viz.*: those affecting the roots, the stems and branches, the foliage, and the fruit.

The chief enemy attacking the root, is the woolly aphis. Of insects affecting the stem and branches, the worst are: borers, scale insects, and aphids, including the green lice and one form of the woolly aphis; the foliage enemies include canker worm, tent caterpillar, red-humped caterpillar, bag worm and green aphis; and the fruit enemies include the codling moth larvae, or “apple worm,” and the curculio. Specific treatment is required for some of these pests, as with the San Jose scale; while in other cases a general application of preventive or destructive measures will answer for several.

The *woolly aphis*, as it appears on the roots, may be destroyed by injecting carbon bisulphide into the soil about the base of the tree; also by removing the top soil for a distance of 2 or 3 feet from the base of the tree, and applying a liberal quantity of tobacco dust. Tobacco dust is the safest and most commonly used remedy. For the woolly aphis on the limbs, spray with kerosene emulsion (formula 7).

Borers, both flat-headed and round-headed, are best destroyed

by means of a knife and a sharp wire; search being made for them on each individual tree every fall and spring. Preventive measures are sometimes used in the shape of protective bands at the base of the tree; also by the use of some sticky substance, like printers' ink, or tanglefoot, which hinders the beetle from laying its eggs.

The *scale insects* which give most trouble are the San Jose scale, the oyster-shell bark louse, and the scurfy bark louse. The standard remedy for all of these enemies is to spray, in winter or early spring, before the buds expand, with the lime-sulphur mixture (formula 1) or with one of the soluble oils (formula 2). This spraying must be done when the trees are dormant—from November to March or April—as suggested on page——.

Aphids, or *plant lice*, which are often so numerous the latter part of the summer, may usually be detected by the presence of ants in the tops of the trees and on the new twigs. These lice injure the tree by sucking the plant food which should go to mature the new growth. The ants themselves do no harm. They simply feed upon the honey dew, a sweet, sticky substance excreted by the lice. To destroy the lice, spray with kerosene emulsion (formula 7) when the insects are discovered. If spraying is delayed until the leaves curl, many of the pests will escape.

For *leaf-eating insects*, like tent caterpillar, canker worm or bag-worm, spray with arsenical poisons (formula 5 or 6) when the insects first appear. Promptness is very important, as the insects are much more easily killed when very young.

For *codling moth* and *curculio*, which attack the fruit, spray with formula 5 or 6, just after the blossoms fall and once or twice later, at intervals of 10 days or 2 weeks. Use formula 6 instead of plain Bordeaux mixture, for general spraying during the summer.

COMMON FUNGOUS ENEMIES.

The most commonly recognized diseases of the apple, in West Virginia, are: apple scab, bitter rot, leaf-spot ("frog-eye"), cedar rust, and canker. With all of these troubles, preventive

measures are of the greatest importance. Destroy all diseased leaves, fruit and wood, and spray with the proper material before the plants are attacked. Spraying may check the spread of some diseases, but it will not serve as a cure.

For *apple scab*, spray with copper sulphate (formula 4) before the buds open; with Bordeaux mixture and arsenate of lead (formula 6) immediately after the blossoms fall, and again 2 weeks later. If the season is very moist, repeat the application once or twice during the summer; but usually 3 or 4 sprayings are sufficient.

For *bitter rot*, remove all diseased fruits which remain on the tree, and burn these, together with all infested fruit and litter under the tree; spray with copper sulphate (formula 4) before buds open,—unless lime-sulphur mixture has been used for the scale; after July 1, spray about once in 2 weeks with Bordeaux mixture (formula 3). If the season is very wet and hot, it may be necessary to spray the particular varieties attacked as often as every week or 10 days, removing and destroying all diseased fruit as it appears; if season is very dry, less frequent spraying is required. Blighted twigs and cankered wood should be removed and burned, and too much emphasis can not be laid upon the importance of burning at once the old mummied fruit, both on the tree and that which has fallen, and the newly diseased fruit as fast as it appears during the summer.

For *leaf spot* ("frog-eye"), destroy all litter and diseased leaves around the trees; spray with copper sulphate (formula 4) or with Bordeaux mixture (formula 3a) before blooming, if lime-sulphur has not been used; spray with Bordeaux-arsenate (formula 6) immediately after blooming, and repeat at intervals of three or four weeks during the season. The number of sprayings required will depend upon the character of the season.

For *cedar rust*, burn all diseased leaves and litter; destroy all cedar trees within $\frac{1}{2}$ mile of the orchard; spray with Bordeaux mixture as for other leaf diseases.

For *canker*, remove and burn all cankered twigs, and cut out cankered spots on trunk and large branches, painting the wounds

with pure white lead and linseed oil to facilitate healing. Canker of the wood appears as one form of several diseases of the apple. Spraying with Bordeaux mixture for these diseases will tend to reduce this trouble.

SUMMARY OF TREATMENT FOR APPLE ENEMIES.

(a). Burn all deceased leaves, fruit and other litter; also cut out and burn all dead limbs and diseased spots on trunk and branches.

(b). For San Jose scale, spray in fall or early spring with lime-sulphur mixture or one of the soluble oils. The lime-sulphur treatment is also an aid in the control of fungous diseases.

(c). In the absence of the lime-sulphur treatment, spray in early spring, before buds open, with copper sulphate or strong Bordeaux mixture.

(d). Spray immediately after blossoms fall with Bordeaux mixture and arsenate of lead, and repeat in about 2 weeks, with subsequent treatments in July and August, for leaf diseases, apple scab, and codling moth. If leaf eating insects prove troublesome at any time, use formula 6.

GENERAL SUGGESTIONS.

1. Wash spray pump and nozzles every time when through using.

2. Keep all materials labelled and out of reach of children and animals, remembering that most spraying materials are *poison*.

3. Mixtures containing copper sulphate or arsenate of lead should be made in wooden tubs or earthen jars, not in tin or galvanized iron vessels.

4. Arsenical sprays should not be applied to fruits just before harvesting.

5. Trees should not be sprayed when in bloom. Such treatment reduces the crop and kills the bees, which latter are among the best friends of the orchardist.

6. Learn to know insects and diseases by their appearances and by their work. No one treatment is effective for all. If in doubt, send a specimen to the Experiment Station.

FORMULAS FOR SPRAYING MIXTURES.

CAUTION: Label all spraying materials distinctly, and mark POISON. Keep such materials out of reach of children and all animals. The formulas here given are for use on the apple, and in many cases they are not suitable for the peach or other tender plants.

FORMULA 1. LIME-SULPHUR MIXTURE.

Fresh Lime (unslaked)	20 pounds
Sulphur	15 pounds
Water	50 gallons

One of the best known remedies for San Jose scale; also an excellent fungicide. To be used only when the plants are dormant, and for the best results should be applied in early spring—March or April—before the buds swell.

For the amount mentioned, slake lime and sulphur together in a large iron kettle; dilute to 15 gallons, and boil for an hour. The liquid should then have changed to a reddish-amber color, and will be ready for use. Dilute to 50 gallons with water, and apply while hot. If more than a few trees are to be sprayed, the most satisfactory method of cooking is to use a jet of live steam and cook in barrels or a tank. Several firms offer a prepared mixture which is apparently satisfactory, but is naturally more expensive than the home made material.

FORMULA 2. SOLUBLE OILS.

Soluble Oil	1 gallon
Water	12 to 15 gallons

Preparations of "soluble oils" are often used as a substitute for the lime-sulphur mixture, and in many cases these preparations are very effective in killing the scale. They have no value as fungicides, however, and cannot be used as late in the season as can the lime-sulphur mixture, without injury to the tree. Specific directions are given with each preparation.

Among the best known of the "soluble oils," are: Target Brand, Scalecide, Kill-o-Scale, San-U-Zay.

FORMULA 3. BORDEAUX MIXTURE.

Copper Sulphate	3 pounds .
Fresh Lime (unslaked)	5 pounds
Water	50 gallons

Get pure lime, well burned. Always dissolve the copper salt in a wooden vessel or earthen jar. It will corrode a tin or galvanized iron pail. For a small amount of the material, not more than a barrel, dissolve the copper sulphate in about 2 gallons of hot water by suspending it from the top of the vessel in a cloth bag; pour the solution into the tank or barrel used for spraying, and fill about half full of water. Slake the lime by the addition of a small amount of water, and when slaked add 2 or 3 gallons of water and stir freely. Pour the milk of lime thus made into the sulphate solution, passing it through a brass wire strainer of about 30 meshes to the inch (No. 50), or through a cheese-cloth backed by common window screen. Stir constantly while adding the lime. Add water to make the desired amount.

In case larger quantities of the mixture are required, the use of stock solutions of lime and copper sulphate will save much time. For this purpose, weigh out 30 pounds of copper sulphate and suspend in a bag from the top of a barrel containing 30 gallons of water. Slake 50 pounds of lime, and add water to make 30 gallons in another barrel. For use, 3 gallons of each material, with 44 gallons of water, make up the formula given above. A third barrel may well be used as a mixing tank, instead of mixing in

spray-tank; but in any case, dilute the copper sulphate solution as directed, before adding the lime. The stock solutions should be kept covered to prevent evaporation, *and should be thoroughly stirred before dipping out.*

FORMULA 3a. STRONG BORDEAUX MIXTURE.

Copper Sulphate	5 pounds
Fresh Lime	5 pounds
Water	50 gallons

Prepared the same as Formula 3. For use early in spring, if the treatment with copper sulphate alone (Formula 4) has been delayed.

FORMULA 4. COPPER SULPHATE.

Copper Sulphate	5 pounds
Water	50 gallons

Dissolve the copper salt as for Bordeaux mixture. For use as a winter fungicide.

FORMULA 5. LEAD ARSENATE.

Lead Arsenate, or Disparene	2 to 3 pounds
Water	50 gallons

Lead arsenate is in many places taking the place of Paris Green as the standard insecticide, since it remains longer in suspension, does not burn the foliage, and adheres better to the leaf surfaces. Make a thin, smooth paste with the poison and a little water, then add the remainder of the water and stir thoroughly.

FORMULA 6. BORDEAUX-ARSENATE MIXTURE.

Arsenate of Lead or Disparene	2 to 3 pounds
Bordeaux Mixture	50 gallons

Make a smooth paste of the poison and a little water; add to the Bordeaux mixture and stir thoroughly. Apply at once. Paris green ($\frac{1}{2}$ pound) may be used in place of the arsenate of lead. This is the universally recognized formula for use as a combined insecticide and fungicide.

FORMULA 7. KEROSENE EMULSION.

Hard Soap	$\frac{1}{2}$ pound
Boiling Water	1 gallon
Kerosene	2 gallons

Dissolve the soap in the water, first cutting it into thin slices to facilitate the process; remove from the stove, add kerosene, and churn through a force pump for 10 minutes. This forms a thick, creamlike stock solution. For use add 1 gallon emulsion to 10 gallons of water. For use on very young tender shoots, add 1 gallon emulsion to 15 gallons of water.

. The standard formula for green lice.

